SUSPENSION BRIDGES.

Fig. 1.

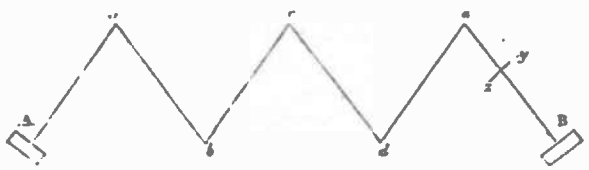


Fig. 2.

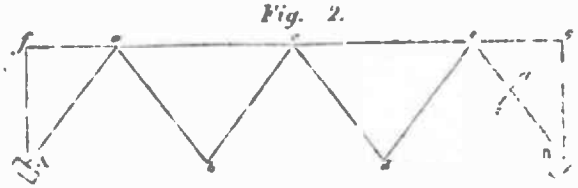


Fig. 3.

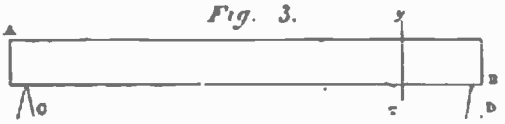
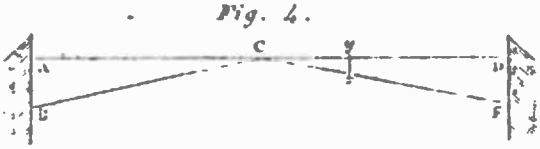


Fig. 4.



SUSPENSION BRIDGES.

Sir,—I perfectly understood the nature of my communication to you the other day, but since I have to explain some part of it, let us quote the whole sentence to which your correspondent B. B. refers:—"I must differ from you in supposing that suspension is more likely suddenly to give way than compression bridges; in proof of the contrary, I will instance the fall of the bridge across the Mill Fleam at Derby, those at Ashton-under-Lyne, and several others that have occurred lately, by which lives have been lost."

Here the failures at Derby and Ashton-under-Lyne are merely brought forward to shew that compression bridges are as liable suddenly to give way as suspension bridges are; and in the following sentence, when I speak of the erroneous principle upon which both suspension and compression bridges are built, none are particularized, though it alludes all (that is all the bridges in which the ontal force concentrates at the apex of the curve), and of course includes those at Derby and Ashton-under-Lyne, of which one, it seems, gave way from the trivial cause of the mortar not being sufficiently dry at the time the centres were struck, and which was as effectually destroyed as when, in the other case, the workmanship in the pier was defective. This shews the truth of my position by supplying an illustration omitted in my letter.

The most orthodox way of discussing the question of a principle is by reasoning mathematically upon the subject, which would directly shew my statement to be correct, but as many of your readers may perhaps prefer a simple common-sense, though rough illustration, to following me through the intricacies of the calculus, we will dispense, in this instance, with mathematics altogether. Suppose A *a b c d e* B, fig. 1, to be a viaduct consisting of three arches, and A and B the extreme abutment. Now, if from defective workmanship, or any other cause, either of these piers were to yield, all the arches would of course be levelled with the ground: or, suppose from the mortar not being sufficiently dry at any part, as *y z*, that part was to yield, the whole viaduct would be as effectually destroyed as in the former case, when one of the piers gave way. But if tension lines *f a a c* &c., be introduced, as in fig. 2, to the apex of each arch, so as to prevent any concentration of horizontal force, then if either of the piers, as B, were removed, not all the structure would be destroyed, but only that portion B *e g*: or if a failure were to take place at any section, *y z*, only a similar portion would be destroyed; the rest would remain as firm as ever. Again, let A B fig. 3, be a beam resting on fulcra C and D, either of which taken away, or a section *x y* made, would cause the beam to fall. But if on the other hand the beam be of the form as fig. 4, one of the piers, as D E, may be removed, whilst the other would still stand, or a section *x y* may be made, and only that portion *x y* E would fall, the rest would stand as firm as ever. Figs. 1 and 3 illustrate that principle which I say is erroneous, and will leave your readers to judge if I am not right.

If the piers of my bridge were to give way, the bridge of course would fall, but if only one was to yield, that part which rested upon that pier only would fall, the rest would stand as exemplified in fig 4.

The reason why suspension bridges have not been employed for railways is because in the common catenary principle the roadway hangs by vertical rods, and is therefore subject to the same motion as the chains, which would endanger the passing train. This, however, ceases to be the case when the suspending rods are arranged obliquely, for then the horizontal force is taken from the chains and resisted by the roadway, which renders it rigid, and over which railway trains may pass with safety.

Bath, July 8th. J. Dando.

P.S. A question may be asked, how if the bridge is perfectly quiescent will the motion endanger a train? When using this expression in my former letter, I was speaking of a motion sufficient to alter the internal structure of iron; now I am alluding to a motion which would endanger a train; the latter of these would be perfectly quiescent as compared with the former.

ON MOSAIC FLOORS AND TESSELLATED PAVEMENTS.*

Let us now glance at the modes in which the decorative arts have been brought into requisition for covering the floors and pavements of buildings, or of forming the pavements themselves. Here, as in other matters, the usages of different ages and of different countries mutually illustrate each other, by shewing that in many instances a fashion after dying away for centuries revives again into new life.

That variety of pavement or flooring which consists of *mosaic* or *tessellated* work was very extensively employed by the Romans, as is evidenced not only by the pavements of still-existing buildings, but in the excavated ruins of Pompeii. The specimens of this art there brought to light are chiefly composed of black frets, or meandering patterns, on a white ground, or white ones on a black ground. The materials of which they are chiefly composed are small pieces of black and white marble, and red tile, some larger than others, so as to take a deeper hold in the mortar than the rest, and thus form a sort of bonding-course which gave stability to the whole. These pieces were set in a very fine cement, laid upon a deep bed of mortar which served as a base.

Pliny describes very minutely the plan adopted by the Romans in making cement or plaster terraces, which may have been the foundation or groundwork on which the tesserm or mosaic pieces were laid. "To make a terrace of this sort," he says, "it is necessary to lay two courses of boards, one athwart the other, the ends of which ought to be nailed, that they should not twist nor warp; which done, take two parts of new rubbish, and one of tiles stamped to powder; then with other three parts of old rubbish mix two parts of lime, and herewith lay a bed of a foot thickness, taking care to ram it hard together. Over this must be laid a bed of mortar, six fingers thick, and upon this middle layer large paving-tiles, at least two fingers deep. This sort of pavement is to be made to rise to the centre in the proportion of one inch and a half to 10 feet. Being thus laid, it is to be planed and polished diligently with some hard stone; but, above all, regard is to be had that the boarded floor be made of oak. As for such as do start or warp any way, they be thought nought. Moreover, it were better to lay a course of flint or chalk between it and the lime, to the end that the lime may not have so much force to hurt the board underneath it. It were also well to put at the bottom a bed of round pebbles. And here I must not forget another kind of those pavements which are called Graecanica, the manner of which is this:—Upon a floor well beaten with rammers is laid a bed of rubbish, or else broken tile-shards, and then upon it a layer of charcoal, well beaten, and driven close together, with sand and lime and small cinders, well mixed together, to the thickness of half a foot, well levelled; and this has the appearance of an earthen floor; but if it be polished with a hard smooth stone, the whole pavement will seem all black."

The above description does not apply immediately to mosaic floors as such, but it serves to show that the Romans practised very extensively the art of forming firm and enduring plaster, one of the important requisites in the production of such floors.

The labour bestowed on some of these mosaics must have been immense; for instead of representing mere checquers of black and white, they form entire pictures, some of which have great beauty of drawing and of colour. The large specimen from the floor of the dining-hall of a house excavated at Pompeii in 1829, called the "House of the Faun," is regarded as the finest example of mosaic flooring yet met with, since it adopts a high style of historical painting as its subject, and is worked out with great skill and elaboration. When it was first discovered the Italian critics were enraptured with it; the vividness and harmony of the colours, the wonderful transparency of the atmosphere, and the correct drawing of the figures, called forth high encomiums. Professor Quarenta has said of it: "The extreme delicacy of this work in marble far surpasses the celebrated mosaic of Palestrina, as well as that of Hadrian's villa, which have hitherto been considered as the greatest wonders in this kind of work. Besides, what are four doves, some masks, and a few small figures, in comparison with a painting in which are represented twelve horses, a large war-chariot, and twenty-two persons, more than half the natural size, without reckoning those that were on the left side, which is almost wholly destroyed?

* From the "Pictorial Gallery of Arts," part vi., published by C. Knight, Ludgate-street. This work presents a mass of instructive matter profusely illustrated by woodcuts, at a cost singularly small. We cordially recommend it to our readers.

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